SCIENCE:

A Weekly Record of Scientific Progress.

JOHN MICHELS, Editor.

Published at

229 BROADWAY, NEW YORK.

P. O. Box 3838.

SATURDAY, JULY 24, 1880.

To Correspondents.

All communications should be addressed to the Editor—Box 3838, P. O., New York—with name and address of writer, not necessarily for publication without consent.

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To Subscribers.

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To Advertisers.

Terms for advertising may be obtained at the office of Journal, 229 Broadway.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

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As it is generally believed that the Boston meeting will be the largest and most important hitherto held, we are completing arrangements with the Executive, by which abstracts of all papers read may be printed in "SCIENCE" contemporaneously with the meeting of the Association, together with a full report of the proceedings; we have reason to believe that such a course will be welcome to the members of the Association, and useful in many respects. In a later number we propose to give fuller particulars in regard to this matter, and in the meantime would be glad to hear from those who will read papers at this meeting, particularly where illustrations are necessary, as by a little co-operation greater justice to the publication of such papers may be attained.

We may state for the convenience of non-members desirous of being admitted as members, that by paying the fees in advance (eight dollars), before the meeting, member's tickets will be sent, which will secure to new members and nominees the same privileges possessed by old members.

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A CURIOUS geological effect has recently occurred in Sicily. On the morning of the 20th May the half of an old château at the seaside, between Catania and Acireale, fell in consequence of alteration of an enormous volcanic rock which had supported it. This rock was about 50m. high and 80m. in circumference; its form nearly cylindrical. It was placed on an older layer of lava, which forms a promontory. The rock is in such a state of disseggregation, that pieces can easily be detached with the hand. The effect seems due to superoxidation of the iron, which it contains in abundance, and to the action of carbonic acid on the calcareous matter in it. The château in question is a very old one, but its walls were entire, and one might visit it in all its parts. Half an hour before the fall, a family of tourists had taken up residence in it, with a view to visiting the Cyclops islands, which rise a short way off.

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TWENTY-NINTH MEETING.

IN conformity with the vote at the last meeting, the Twenty-ninth meeting of the Association will be held at Boston, Mass., commencing at ten o'clock, A. M., on Wednesday the 25th of August, 1880. A large and efficient Local Committee has been formed and through its several subcommittees is engaged in perfecting the local arrangements for the meeting, which will be announced by special circular as early as possible. It is only necessary to state here that the members of the committee are desirous of doing everything in their power to promote the objects of the Association. As it is generally believed that the Boston meeting will be the largest and probably the most important hitherto held by the Association, every effort will be made by the officers of the Association residing in Boston and vicinity, co-operating with the Local Committee, to prepare a satisfactory general programme for the week (subject to the approval of the Standing Committee) in advance of the meeting, the substance of which will be given in the circular of the Local Committee. To this end several votes were passed at the last meeting of the Standing Committee in Saratoga, and the attention of members is particularly directed to the new clause in relation to titles of papers; also to the probable necessity of forming additional subsections.

The Headquarters of the Association will be at the Massachusetts Institute of Technology, where members will register as soon as possible after arrival. The Hotel Vendôme, corner of Commonwealth Ave. and Dartmouth St., has been selected for Hotel Headquarters.

The offices of the Local Committee and of the Permanent Secretary will be at the Institute of Technology. The General Sessions will be held in Huntington Hall in the same building. The several Sections, Subsections and Committees will have their places of meeting designated on the programme for Wednesday.

The circular which will soon be issued by the Local Committee will contain full information in relation to Hotels and Boarding houses in Boston and vicinity with which special arrangements have been made.

The *Permanent Subsection of Chemistry* will be continued at Boston under the chairmanship of Professor John M. Ordway, of Boston.

The *Permanent Subsection of Microscopy* will be presided over by Prof. S. A. Lattimore, of Rochester, and the active co-operation of microscopists is requested. Arrangements have been made for the proper care of instruments, etc.

The *Permanent Subsection of Anthropology* will be under the chairmanship of Prof. J. W. Powell, of Washington. For special circular and information in relation to this subsection, address Judge J. G. Henderson, *Secretary*, Winchester, Ill,

The attention of entomologists is directed to the annual meeting of the Entomological Club of the Association, which will be held at the rooms of the Boston Society of Natural History at two o'clock, on Tuesday August 24, at which all interested are invited to be present. Mr. S. H. Scudder, of Cambridge, President; Mr. B. P. Mann, of Cambridge, Secretary of the Club. (A special circular concerning this meeting will be sent to all requesting it.)

At the Saratoga meeting the desirability of forming a new subsection in the Association, which should be devoted to *Physiology* and *Anatomy*, was discussed with the special object of inducing members interested in Human Physiology to bring their papers before the Association and also of obtaining the active co-operation of Physicians and Surgeons in the work of the Association. The interest taken in the proposition at Saratoga was such that a permanent organization of the new subsection is expected at the Boston meeting. It will also, probably, be found necessary to form a subsection of Geology and Physical Geography at the Boston meeting.

Several excursions will be arranged for by the Local Committee. Among others, one is planned for Salem and another down the Harbor. On Thursday, the Association will probably hold a morning session in Cambridge, after which visits will be made to the various departments and Museums of the University, followed by a reception at the Botanic Garden and the Observatory in the evening.

All communications relating to the local arrangements for the Boston meeting must be made to the *Local Secretaries* at Boston, while all matters relating to membership and to the presentation of papers will be attended to by the *Permanent Secretary*.

Attention is specially requested to the following articles of the Constitution of the Association.

ART. 3. Any person may become a Member of the Association upon recommendation in writing by two members or fellows, nomination by the Standing Committee, and election by a majority of the members and fellows present in general session.

(Blank forms for recommendation to membership will be furnished on application to the Permanent and Local Secretaries, and, until the day of the meeting, they will receive the recommendations for the General Secretary; after the meeting has begun, recommendations must be given to the General Secretary.)

ART. 4. Fellows shall be nominated by the Standing Committee from such of the members as are professionally engaged in science, or have by their labors aided in advancing science. The election of fellows shall be by ballot and a majority vote of the members and fellows present in general session.

ART. 5. Any person paying to the Association the sum of one thousand dollars shall be classed as a Patron, and shall be entitled to all the privileges of a member and to all its publications.

ART. 7. The name of any member or fellow two years in arrears for annual dues shall be erased from the list of the Association, provided that two notices of indebtedness at an interval of at least three months, shall have been given; and no such person shall be restored until he has paid his arrearages or has been reëlected.

ART. 33. The admission fee for members shall be five dollars in addition to the annual assessment. On the election of any member as a fellow an additional fee of two dollars shall be paid.

ART. 34. The annual assesment for members and fellows shall be three dollars.

ART. 35. Any member or fellow who shall pay the sum of fifty dollars to the Association, at any one time, shall become a Life Member, and as such shall be exempt from all further assessments, and shall be entitled to the Proceedings of the Association. All money thus received shall be invested as a permanent fund, the income of which shall be used only to assist in original research unless otherwise directed by unanimous vote of the Standing Committee.

ART. 36. All admission fees and assessments must be paid to the Permanent Secretary, who shall give proper receipts for the same.

ART. 27. All members and fellows must forward to the Permanent Secretary, as early as possible, and when practicable before the convening of the Association, full titles of all the papers which they propose to present during the meeting, with a statement of the time that each will occupy in delivery, and also such abstracts of their contents as will give a general idea of their nature; and no title shall be referred by the Standing Committee to the Sectional Committee until an abstract of the paper or the paper itself has been received.

(Blank forms for giving the titles and abstracts of papers will be furnished by the Permanent Secretary on application. The Standing Committee particularly request, in order to facilitate the arrangement of the programme, that the titles and abstracts should be forwarded so as to reach the Permanent Secretary before August ninth. At the Saratoga meeting the *Permanent Secretary* was instructed *not to enter*, on the list of papers to be presented, any titles of papers until an abstract of the paper, or the paper itself, was received.)

Notice of errors in the printed list of Members of the Association, of change of address, and information respecting the decease of Members, should be sent to the Permanent Secretary in order that due notice may be taken of the same in the next volume of "Proceedings." It is particularly requested that the Permanent Secretary be notified at once of any errors in the names and addresses that will be given in the list in the Saratoga volume, as a revised edition of the list will be printed for circulation at the Boston meeting.

The Saratoga volume (vol. 28) will soon be distributed by mail to every member who has paid the assessment for the Saratoga meeting.

The volumes of the Proceedings of the Association (28 in number) can be obtained from the Permanent Secretary, at the price of $1.50 a volume; or any member wishing for ten or more volumes, in order to complete a set, may obtain them at $1.00 a volume. The volumes may be had bound in cloth for the extra price of fifty cents each, or in one-half Turkey morocco for the extra price of $1.00 each. Uniform cloth covers for the volumes will be furnished by mail at thirty cents each, or by express or at the meetings for twenty-five cents each. Copies of Volumes 2 and 26 will be received in exchange for other volumes or will be purchased at $1.00 each.

The Memoir on Fossil Butterflies, by Mr. S. H. Scudder, published by the donation of Mrs. Elizabeth Thompson, 4to, 1875, will be furnished at $2.00 a copy. The Transactions of the Association of Geologists and Naturalists, 1 vol. 8vo, 1843, bound in cloth, can be obtained at $3.00 a copy.

It will save much time and confusion at the meeting if members will send their assessments *in advance* to the Permanent Secretary, in return for which a Member's ticket, bearing a receipt for the Boston meeting will be forwarded. Members not intending to be present at Boston, are particularly requested to send their assessment in advance, and to those who specially request the same a copy of the Boston Daily Programme will be mailed.

The address of the PERMANENT SECRETARY, F. W. Putnam, Esq., will be *Salem*, Mass., *until August 1st;* after that time, and until the meeting has adjourned, his office will be at the MASSACHUSETTS INSTITUTE OF TECHNOLOGY, *Boston, Mass.*

ON "LIMNOCODIUM VICTORIA," A HYDROID MEDUSA OF FRESH WATER.

A short time since I received from Mr. Sowerby, Secretary of the Royal Botanical Society, a letter informing me of the occurrence of certain Medusoid organizations in the warm-water tank devoted to the cultivation of the *Victoria regia* in the Gardens of the Society. The letter contained a request that I should examine the animals with a view to their determination; Mr. Sowerby accompanied it with rough sketches, and offered to place specimens at my disposal.

The discovery of true freshwater Medusæ was so startling a fact that I lost no time in calling on Mr. Sowerby, with whom I visited the tank, and carried away such specimens as were needed for examination.

The water in the tank had then a temperature of 86° F., and was literally swarming with little Medusæ, the largest of which measured nearly half an inch in transverse diameter. They were very energetic in their movements, swimming with the characteristic systole and diastole of their umbrella, and apparently in the very conditions which contribute most completely to their well being.

As it now became evident that the Medusa belonged to a generic form hitherto undescribed, I prepared for the Linnean Society a paper containing the results of my examination, and assigning to the new Medusa the name of *Limnocodium victoria* (λίμνη, a pond, and κώδων, a bell). This was received and recorded by the secretaries on June 14, and read at the next meeting, on the 17th.[1]

The umbrella varies much in form with its state of contraction, passing from a somewhat conical shape with depressed summit through figures more or less hemispherical to that of a shallow cup or even of a nearly flat disk. Its outer surface is covered by an epithelium composed of flattened hexagonal cells with distinct and brilliant nucleus. The manubrium is large; it commences with a quadrate base, and when extended projects beyond the margin of the umbrella. The mouth is destitute of tentacles, but is divided into four lips, which are everted and plicated. The endoderm of the manubrium is thrown into four strongly-marked longitudinal plicated ridges.

The radial canals are four in number, they originate each in an angle of the quadrate base of the manubrium, and open distally into a wide circular canal. Each radial canal is accompanied by longitudinal muscular fibres, which spread out on each side at the junction of the radial with the circular canal.

The velum is of moderate width, and the extreme margin of the umbrella is thickened and festooned, and loaded with brownish-yellow pigment cells.

The attachment of the tentacles is peculiar. Instead of being free continuations of the umbrella margin, they are given off from the outer surface of the umbrella at points a little above the margin. From each of these points, however, a ridge may be traced centrifugally as far as the thickened umbrella margin; this is caused by the proximate portion of the tentacle being here adnate to the outer surface of the umbrella. It holds exactly the position of the "mantelspangen" or *peronia*, so well developed in the whole of the Narcomedusæ of Haeckel, and occurring also in some genera of his Trachomedusæ. Its structure, however, differs from that of the true *peronia*, which are merely lines of thread cells marking the path travelled over by the tentacle as the insertion of this moved in the course of metamorphosis from the margin of the umbrella to a point at

[1] Some facts in addition to those contained in my original paper are included in the present communication.

some distance above it, while in Limnocodium the ridges are direct continuations of the tentacles whose structure they retain. They become narrower as they approach the margin.

The number of the tentacles is very large in adult specimens. The four tentacles which correspond to the directions of the four radial canals, or the perradial tentacles, are the longest and thickest. The quadrant which intervenes between every two of these carries, at nearly the same height above the margin, about thirteen shorter and thinner tentacles, while between every two of these three to five much smaller tentacles are given off from points nearer to the margin, and at two or three levels, but without any absolute regularity; indeed, in the older examples all regularity, except in the primary or perradial tentacles, seems lost, and the law of their sequence ceases to be apparent.

I could find no indication of a cavity in the tentacles; but they do not present the peculiar cylindrical chord-like endodermal axis formed by a series of large, clear, thick-walled cells which is so characteristic of the solid tentacles in the Trachomedusæ and Narcomedusæ. From the solid tentacles of these orders they differ also in their great extensibility, the four perradial tentacles admitting of extension in the form of long, greatly-attenuated filaments to many times the height of the vertical axis of the umbrella, even when this height is at its maximum; and being again capable of assuming by contraction the form of short thick clubs. Indeed, instead of presenting the comparatively rigid and imperfectly contractile character which prevails among the Trachomedusæ and the Narcomedusæ, they possess as great a power of extension and contraction as may be found in the tentacles of many Leptomedusæ (Thaumantidæ, &c.) These four perradiate tentacles contract independently of the others, and seem to form a different system. All the tentacles are armed along their length with minute thread cells, which are set in close, somewhat spirally arranged warts.

The lithocysts or marginal vesicles are, in adult specimens, about 128 in number. They are situated near the umbrellar margin of the velum, between the bases of the tentacles, and are grouped somewhat irregularly, so that their number has no close relation with that of the tentacles. They consist of a highly refringent spherical body, on which may be usually seen one or more small nucleus-like corpuscles, the whole surrounded by a delicate transparent and structureless capsule. This capsule is very remarkable, for instead of presenting the usual spherical form, it is of enlongated piriform shape. In its larger end is lodged the spherical refringent body, and it thence becomes attenuated, forming a long tubular tail-like extension which is continued into the velum, in which it runs transversely towards its free margin, and there, after usually becoming more or less convoluted, terminates in a blind extremity.

The marginal nerve-ring can be traced running round the whole margin of the umbrella, and in close relation with the otolitic cells. Ocelli are not present.

The generative sacs are borne on the radiating canals, into which they open at a short distance beyond the exit of these from the base of the manubrium. They are of an oval form, and from their point of attachment to the radial canal hang down free into the cavity of the umbrella. Some of the specimens examined contained nearly mature ova, which, under compression, were forced from the sac through the radial canal into the cavity of the stomach.

While some of the characters described above point to an affinity with both the Trachomedusæ and Narcomedusæ, this affinity ceases to show itself in the very important morphological element afforded by the marginal bodies. In both Trachomedusæ and Narcomedusæ the marginal bodies belong to the tentacular system; they are metamorphosed tentacles, and their otolite cells are endodermal, while in the Leptomedusæ, the only other order of craspedotal Medusæ in which marginal vesicles occur, these bodies are genetically derived from the velum. Now in Limnocodium the marginal vesicles seem to be as truly velar as in the Leptomedusæ. They occur on the lower or abumbral side of the velum, close to its insertion into the umbrella, and the tubular extension of their capsule runs along this side to the free margin of the velum, while the delicate epithelium of the abumbral side passes over them as in the Leptomedusæ. It is true that this point cannot be regarded as settled until an opportunity of tracing the development is afforded; but in very young specimens which I examined I found nothing opposed to the view that the marginal vesicles were derived, like those of the Leptomedusæ, from the velum.

Important points still remain to be cleared up regarding the development of Limnocodium and the determination of the question whether the Medusa be derived from the egg directly or only through the intervention of a hydranlid trophosome. I have arranged, with Mr. Sowerby, some methods of observation by which I hope to obtain data for determination of these points.

If this be the case Limnocodium will hold a position intermediate between the Leptomedusæ and the Trachomedusæ; but as the greatest systematic importance must be attached to the structure and origin of the marginal vesicles, its affinity with the Leptomedusæ must be regarded as the closer of the two. GEO. J. ALLMAN.

THE ELECTRIC LAMPS OF M. TCHIKOLEFF.

M. Tchikoleff, the head of the electric lighting department of the Russian artillery, has addressed to *La Lumière Electrique* a communication, of which the following is a translation, in which he claims that the application of derived currents which has been successfully adopted with the lamps of MM. Lontin and Siemens, was employed by him as far back as the year 1871.

"Having experimented for a lengthened period with the Foucault and Serrin regulator lamps, which were considered to be the best at the period when I took up the question, I was able to observe in them the following defects:

1. Several lamps, arranged in series or in multiple arc in a circuit, would not continue to work.

2. These lamps could be worked only by very powerful currents, whereas with a lamp regulated by hand the voltaic arc could be obtained with weaker currents, giving of course a less intense light.

3. They worked with regularity only when the current was constant, or varied within very restricted limits.

I traced the cause of these defects to the fact that the working of the regulating mechanism was based upon a kind of equilibrium between the attractive force of an electro-magnet and the counteracting force of a spring. Such a system does not regulate the distance between the charcoal points, but only the general force of the current in the circuit. Now under these circumstances it is possible that, when two or more lamps are placed in series in a circuit, one of them may have its carbons in contact, whilst the carbons of the other lamp or lamps are at a greater or less distance apart, without the equilibrium between the electro-magnets and the counteracting springs being disturbed.

Now it was to obviate this defect that I endeavored to devise an arrangement which, whilst allowing each lamp placed in a circuit to be independent of the general intensity of the current and its variations, would enable it to maintain constant the resistance of its own voltaic arc, and this arrangement appeared to me obtainable by applying to the regulator lamps the principle of the *differential action of derived currents*.

It was in 1869 that I made the first experiment on the foregoing arrangement with a regulator lamp of M. Foucault, the counteracting spring of which I replaced by a supplementary electro-magnet traversed by a very weak derivation of the current, parallel to the voltaic arc. This electro-magnet was wound with a wire of high resistance, and the current producing the voltaic arc passed through the other electro-magnet. The armatures of these electro-magnets were placed at the two extremities of a rocking-lever, carrying at its centre of oscillation an arm which controlled the mechanism for increasing or diminishing the distance between the carbons; and the rocking-lever was in equilibrium when the voltaic arc possessed its normal resistance.

It is easy to understand that, with this arrangement, as the resistance of the arc becomes greater, the strength of the electro-magnet through which the current passes decreases, whilst the other electro-magnet becomes more powerful; so that the arm no longer remains in its vertical position, and by its inclination influences the mechanism which brings the carbons closer together. The contrary effect is of course produced when the inverse action occurs. An arrangement which, like the one in question, maintains constant the resistance of the arc evidently does not exert any effect upon the general intensity of the current in the circuit; for the variations of this intensity, outside of the lamp, exert always the same effect upon the two electro-magnets which control the latter.* The experiment with the Foucault lamp gave such good results that I decided to undertake the construction of a new lamp as free as possible from the defects inherent to the Foucault regulator, and to those based upon the same principle.

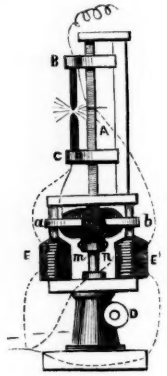

FIG. 1.

After some carefully made experiments with lamps having automatic regulation, and others regulated by hand, I ascertained that the latter would give a constant light with a much less number of battery cells than was requisite with the former. Thus with hand regulators I could obtain satisfactory results with 24 or even 20 Bunsen elements, whilst with the Foucault and Serrin regulators it was necessary to employ at least 40. The cause of this in the first place is that, in these regulating lamps the movements communicated to the carbons are always too sudden (*prompte*) for comparatively weak currents, and, in the second place, that these movements are constant instead of being proportionate to the intensity of the current passing by the voltaic arc. From this I naturally came to the conclusion that, in order to obtain a lamp suitable for practical working, it was necessary to apply the following three principles, which I consider as fundamental:

1. To maintain constant the resistance of the voltaic arc we should not employ a constant mechanical force such as that of a spring, but a weak derivation from the main current, parallel to the voltaic arc.

2. To obtain by means of a special derivation from the main current the movements augmenting or diminishing the distance between the carbons, in order that the rapidity of these movements may be proportionate to the intensity of the current producing the voltaic arc.

3. To make arrangements such that this rapidity of the movements communicated to the carbons should, at certain periods, be proportionate to the variations in their distance; that is to say to arrange the apparatus so that, in the case where the carbons have to be moved towards each other through an appreciable space, the movement communicated to them may be more rapid than when they have to be moved through a very short distance.

In 1871 I had constructed a lamp which fulfilled the two first of these principles, and which was brought before the Moscow Society of naturalists. In this system I employed as motor a small electro-magnetic machine of Froment, worked by a derivation from the principal current passing by the carbons; and above this electro-motor, the axis of which was vertical, were placed the two electro-magnets of the differential system above referred to. An armature common to both and suspended between their poles like a pendulum, reacted upon a double system of gearing, the axis of which, furnished with two angle-wheels of unequal diameter, would present to the electro-motor one or the other of these wheels according as one or the other of the two electro-magnets was the more energetic. As the wheels in question corresponded to two opposite points of the driving wheel, the movements produced were in opposite directions and could increase or diminish the distance between the carbons with a rapidity greater or less according to the intensity of the current, since the working of the motor was dependent upon this intensity. The drawing of this lamp has been in the polytechnic museum of Moscow since the commencement of the year 1873.

At the end of 1873, M. Jablochkoff, who at that period had a mechanical workshop at Moscow, being convinced of the superiority of the systems of constructing lamps on the derived current principle, made in his workshop a lamp on this principle. I shall not refer to the experiments with this lamp, which gave full satisfaction to several persons. For my own part, I was but partially satisfied, on account of its complication, and because it did not fulfil the third of the fundamental principles I had laid down.

In 1874, I arranged a new lamp, the design of which I brought before the physical section of the Moscow Society of Naturalists, and which is represented by Fig. 1.

E E′ are electro-magnets disposed like those on the other systems and having poles, *a b*, spread out in circular form as in the Gramme machine. K is a Gramme or Siemens ring, the rotary motion of which causes the carbons to move through the intermediary of a double-thread screw, A, and two nuts, B C, which carry the carbons. Lastly, D is a regulating screw, for the purpose of raising or lowering the luminous focus.

The current passes from the positive pole of the generator to the negative pole by three derivations, one of which includes the arc and traverses the ring by means of the contact-pieces *m n*; whilst a second, also including the arc, excites the electro-magnet E (or both electro-magnets in a given direction); and a third which, without passing by the arc, influences the high resistance magnet E′ (or both magnets in contrary directions), so that the action of this magnet upon the ring shall be in a reverse direction to that of E.

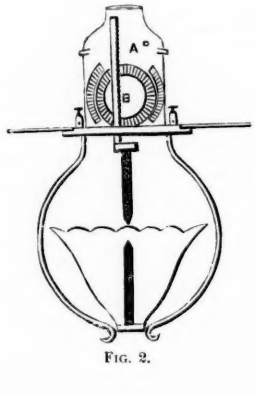

FIG. 2.

In consequence of this arrangement the action of the electro-magnets upon the ring K is almost *nil* when the arc possesses its normal resistance; but when the resistance of the arc augments the action of the electro-magnet, E becomes weakened, allowing E′ to preponderate, and the ring K will rotate so as to bring the carbons into closer proximity. The contrary effect will, of course, be produced if the resistance of the arc should diminish.

*This is somewhat obscure; what is meant, perhaps, is that the sum of the currents traversing the two magnets is, with the adjustments adopted, a constant value.—ED. *E*.

Experience has shown that with such a lamp it is possible to obtain, with regularity and safety, a good electric light with twenty-four Bunsen cells, and at first with even twenty cells. Some of these lamps have been in use in the Russian artillery since 1877. This lamp may also be constructed on the principle of the Wheatstone balance.

The form of my lamp intended for public lighting is represented by Fig. 2. The rod A, with the upper carbon-holder works by the effect of its own weight. When the current traverses the lamp the distance between the two carbons is maintained by the aid of helical coils, but these coils and the toothed wheel which controls the movements are worked, as in the former case, on the principal of derivati ons. When the current is interrupted, the carbons come into contact by the effect of the weight of the rod A.

I omit here certain details of construction which are of importance in order that the lamp may work properly.

To sum up, the advantages of my lamp may be enumerated as follows:

1. Its construction is extremely simple, it is free from clockwork mechanism, springs and electrical contacts.

2. It does not require preliminary regulation nor any manipulation before or during its working.

3. Several of these lamps may be arranged in series in a circuit, and they are always in due relation with the intensity and the tension of the current which is to act upon them.

4. The lamp can work with comparatively weak currents, and also produce a very powerful light when the power of the current is augmented.

I am convinced that the problem of the divisibility of the electric light by means of lamps having a voltaic arc can be solved only with the lamps based on the principle of the derivation of the current, which I discovered prior to Messrs. Lontin and Siemens.

Lamps with movable carbons offering a certain resistance between their polar extremities are moreover far preferable, from the point of view of divisibility, to lamps with fixed carbons (with carbons at a fixed distance?) which may offer great variations in the resistance of the arc, in consequence of impurities, the action of the wind, &c. These variations may in fact be greatly reduced in the former description of lamp, and it is not necessary with them to employ currents of such high tension or, if such currents be employed, additional lamps may be inserted in the circuit.

W. TCHIKOLEFF.

GENERAL NOTES.

CLIMATIC influences have of late been rather against phylloxera, which has shown, therefore, a decreased activity for a time. According to M. Boiteau, the treatment with sulphide of carbon and sulphocarbonate of potassium these past three years past seems to have had even a stimulating effect on the vines (besides ridding them of the insect). Some of the vines thus treated are flourishing better than before the parasite appeared.

M. CHARNAY, the leader of the expedition recently sent to Central America under the auspices of the governments of the United States and France, the expenses of which are to be largely borne by Mr. Pierre Lorillard, telegraphs that the Mexican government has signed a treaty giving him all the privileges and facilities he needs in making explorations and has appointed a representative to accompany him.

MARIE EKUNINA describes, in the *Journal für Praktische Chemie*, an investigation conducted in Professor Nencke's laboratory at Berne, on the causes of acid reaction of the animal tissues after death. This reaction is attributed to the decomposition of tissue juices, after death, by fungi. Volatile fatty acids first arise through commencing decomposition of albumin, but very soon the two lactic acids proceeding from glycogen are associated with these. The richer the tissue in carbohydrates, the longer does the acid reaction continue after death; this is especially the case with liver, muscles, and lungs. The shortest and weakest acid reaction is that in the pancreas. Sooner or later, in all tissues, the acid reaction passes over into an alkaline, while the decomposition of albumin increases, and there is much formation of ammonia.

CORRESPONDENCE.

We have been requested by a correspondent of Lieutenant Colonel Ross to publish the annexed letter, which at present may be accepted as an *ex-parte* statement, which complains of a wrong done to him by certain members of the Royal Society. But while placing our columns at the disposal of Col. Ross, we disclaim any personal responsibility in the matter, and will afford ample space for any reply which Professor H. E. Roscoe, or others concerned, may decide to forward to us for publication. Lt. Col. Ross is well known for his works on Blow-pipe Analysis, and has recently published a small manual on this subject, which we find favorably spoken of by the English Scientific press.—[ED.]

LONDON, 11th June, 1880.

To the Secretary of the Royal Society.

SIR.—In forwarding a copy of my new work on the Blowpipe, for the Library of the Royal Society (which I did yesterday), I have the honor and pleasure to inform you for communication to them, that I have now, beyond reasonable doubt, discovered the coloring principle of the *Sapphire*, and can produce stones made chiefly of alumina, of almost any required tint of blue, green, or "amethyst," *without using any chromatic oxide whatever*, a discovery I believe to be quite unique, for, although a Belgian or French chemist has made real "rubies," he is obliged to color them with manganese or other metallic oxide. I do not propose, however, to communicate this secret to the Royal Society, as I at first intended, for the following reason: When in the Spring of 1873, the Secretary of your Society, with the discriminating perception of the useful and novel which is characteristic of men of genius, came to Woolwich to examine experiments which I was then (as a Captain in the Royal Artillery) making in blow-pipe analysis, and eventually read a paper on the subject before your Society, I little thought that influential opposition instituted by Fellows of your Society, would be the chief cause of retarding my humble efforts in the progress of this new science for nearly ten years. I have, however, the most reliable evidence to prove that Professor H. E. Roscoe, F. R. S., and another Fellow of your Society whom I need not mention here, circulated the most disparaging and depreciatory opinions regarding the novel statements on this subject contained in my work "Pyrology," (a detailed exposition of the views first propounded in the paper read before your Society,) the MS. of which was offered by me to Messrs. Macmillan & Co., in 1874, for publication and declined by them, presumably on the advice of Prof. Roscoe.

Of course I have no right, nor do I for a moment wish to complain of the adverse opinion of eminent men of science, though perhaps such opinions would be more suitably expressed in public so as to give me an opportunity of reply; but what I venture most respectfully now to complain of, is that one of my inventions in Blowpipe Analysis—the use of Aluminium plate—which had been disparaged as above mentioned, has now been *adopted* by that department of Owens College, Manchester, over which Prof. Roscoe so eminently and justly presides, and that a German work on the subject, translated in that department, has interpolated in it an account, spread over thirteen pages, of the very Aluminium plate reactions rejected by Prof. Roscoe in 1874, and, worst of all, the invention is attributed to somebody else in the index of the book, which has been adopted as a text book by the Owens College.

As I have sustained a serious loss by the publication of my work on the subject, chiefly through the opposition above referred to, I would most respectfully ask the council of your society whether they do not think it fair that I should reap any benefits *now*, derivable from my inventions or discoveries? I have the honor to be, Sir,

Your most Obedient Servant,
W. A. ROSS, Lt. Colonel,
Royal Artillery (retired list).

The Secretary Royal Society,
Burlington House, Piccadilly W.

THE "D-LINES" SPECTRA.—ARE THEY DUE TO WATER?

By Lieut-Colonel W. A. Ross, late R. A.

In the year 1834, Mr. Fox Talbot, F. R. S., attributed the all but omnipresent rays affording the above-named spectra to water, on account of its universality; but the celebrated experiment of Kirchoff has, since then, reversed that opinion, and bestowed the power of emitting orange rays upon sodium alone.

Is it not more reasonable, however, to suppose that sodium has more attraction for water than any other substance, than to imagine sodium contained in every possible substance, from the eternally-burning Sun himself, down to every particle of our atmosphere?

A man need not be a chemist, or pyrologist, to observe that, if he holds in platinum tongs a fragment of marble, or artificial carbonate of lime, or magnesia, before the blowpipe, a strong orange flame affording "D-lines" spectra is emitted by the fragment, *only so long as it is imperfectly calcined*, or, in other words, has lost its carbonic acid gas. When calcination is complete, it begins to glow brightly, and emits no colored "flame" at all. Let us call this orange flame (*a*) in this case. According to modern chemical theories (*a*) can only be one of two things; carbonic acid gas or sodium. It cannot be carbonic acid, which so far from being combustible, is used to "put out" flame. It can be proved not to be sodium by making it impinge upon a bead of pure transparent boric acid, in which it causes, after a time, *opalescence*. This opalescence is *removed* by the similar impingement upon the bead of an indubitable sodium orange flame. Reasonable chemists, therefore, will not be inclined to contradict Euclid that the same cause producing precisely opposite effects is a *reductio ad absurdum*. Moreover, for the supposed sodium to have been with the marble, and not with the marble after calcination—"*hic et ubique*," like the ghost of Hamlet's papa—is another absurdity, which no modern chemist would require us to believe, although some are very exacting if not always exact. May I hope that most chemists will be now inclined to admit, first, that (*a*) can be due neither to sodium nor to carbonic acid; and secondly, that it must, therefore, be due to something else: and this is the very impression that occurred to me after thinking profoundly over the matter for several years.

Indeed, I suggested to Mr. Hennessy, who was engaged in making atmospheric observations at Mussooree, in India, with a spectroscope belonging to the Royal Society—and who was elected an F.R.S. for his pains—that the "D-lines" were due to water, not sodium, so long ago as 1871, and he was very much struck by the suggestion.

The methods I adopted to prove the truth (or improbability) of the suspicion which thus arose in my mind were as follows:

1.—The whole of (*a*) in a weighed fragment of pure marble was obtained by fusing it carefully before the blowpipe in a transparent bead of boric acid, when the carbonic acid gas, which we may call (*b*), escaped in bubbles with great effervescence, (*a*) remaining behind as opalescence, and the lime (*c*) combining with a portion of the boric acid to form a ball contained in the bead—let us call the bead (*d*). I found the weight of the lime borate ball (*c a*) bore the same relative proportion to that of the marble (*a b c*) whether the latter had been previously calcined or not, so that the opalescence in (*d*) could not possibly have been part of (*c*) while (*b*) escaped in bubbles; therefore the opalescence *must* have been due to (*a*) or—

$$(a\ b\ c) + 2\ (d) - (b) = \left\{\begin{matrix}\text{(ball)}\\ (c\ d)\end{matrix}\right\} + \left\{\begin{matrix}\text{(hydrated boric acid)}\\ (a\ d)\end{matrix}\right\}$$

I could not isolate (*a*) any further than this, because (*a d*) or what I believed to be *hydrated boric acid* is, naturally, as soluble in water as ordinary boric acid, so I tried—

2.—Observing that platinum in considerable bulk also produces (*a*) in a ratio increasing with the decrease of temperature down to a dull red heat, I fused an ounce of crystallised boric acid in an open platinum dish at red heat, and obtained a new kind of boric acid, which turns brown with a strong *resinous smell*, on being ignited, like that of burning sealing-wax, affords a slightly-oranged "flame"—for the green pyrochrome of the boric acid overpowers that of (*a*),—and forms an opalescent bead, which reacts, as I believe, with much greater acidity before the blowpipe than ordinary boric acid does.

This I call *platinised* or *hydrated boric acid*, and shall be happy to show it to any chemist who may consider the matter to be sufficiently interesting.—*English Mechanic.*

AN IMPORTANT DISCOVERY.

A discovery in chemistry has just been published, which bids fair to influence agriculture in a manner that may be well described as revolutionary. It must soon compel the attention of farmers and manufacturers of artificial manures everywhere. The essential part which ammonia plays in vegetation need not here be dweit upon, and no one will question the desirability of securing it cheaply and in quantity. The importance of the recent feat of Messrs. Rickman & Thompson, of England, disclosing a plan by which ammonium sulphate can be made and sold with profit at two cents a pound, will not, therefore, be liable to be overestimated. The following account of the process is taken from the *Chemical News*:

Within the last twenty years the manufacture of ammonia synthetically has been several times attempted, and though in every attempt it is probable that ammonia has been made, it has never been produced on a commercial scale. In all these attempts the process has been to combine the nitrogen and hydrogen directly at a low temperature, and receive the ammonia in solution in water, or by substitution, first forming a cyanide at a higher heat, and then indirectly producing ammonia by the decomposition of the cyanide, the result in both cases being ammonia in solution with water. Rickman & Thompson's procedure is altogether different, they produce ammonium chloride direct, either in dry powder or in solution, and this by the simplest and most inexpensive means. Instead of employing retorts, as in all other places, they merely use a closed brick furnace, the ash-pan of which regulates the supply of air, and they cause the vapor of water to be produced by the waste heat of the furnace itself. With the exception of about a bushel of coke for starting the furnace, the deoxidizing material and only fuel used is coal-dust. The great difficulty in making ammonia from the nascent hydrogen of water and the nitrogen of the air is the restricted limits of temperature between generation and decomposition, it being necessary that carbon, however used, should be at a full red heat to decompose the vapor of water, and at a bright-red heat to decompose ammonia. Now, ammonium chloride under the same conditions is simply volatilized and not decomposed. As chloride of sodium or of calcium is decomposed at a full red heat in presence of nascent ammonia, therefore one of these chlorides is mixed with the coal that ammonium chloride may be formed; so that if by chance the heat should be raised to a bright red, no loss will be sustained—the ammonium chloride is simply volatilized. By these means a greater range of working temperature is obtained. At the present time, with the consumption of from 20 to 28 lbs. of coal-dust and salt mixed, from two or three lbs. of ammonium chloride is formed.

A New Audiphone.—Further experiments on the timbre of musical instruments as rendered by the audiphone have led me to the selection of the following as a distinct improvement on the birchwood veneer, both for musical purposes and also for ordinary conversation. It has the same advantage as my previous form in not requiring to be held by the hand, it costs nothing, and requires no making. Take a sheet of stiff brown paper about 11 x 15 inches, the paper being such as is ordinarily used for making up heavy parcels. Put the ends together, the middle forming a loop, and hold the ends between the teeth. The paper must be pretty stiff, as the loop must stand out round and full, and of course the paper must be without folds or creases. Thomas Fletcher.

SATURDAY, JULY 31, 1880.

THE CEREBRAL FISSURES OF THE DOMESTIC CAT, *Felis domestica*.

BY BURT G. WILDER, M. D.

The discovery of the electrical excitability of certain cerebral convolutions renders more than ever desirable some common nomenclature of the folds themselves and of the fissures by which they are defined. For various reasons, some of which were stated by me in 1873 (11,219), the *fissures* should first be identified, and their names agreed upon.

Two notable contributions to fissural homologies and terminology have been recently published by Julius Krueg. An abstract of the paper on Herbivora was given by Horsley in *Nature* for January 23, 1879. The second paper, upon the fissures of the Proboscidea, Hyracoidea, and Carnivora, was published in January of the present year, but did not reach the libraries in this country until May. The larger part of the paper is devoted to the Carnivora, and will prove more useful, practically, than the remainder. After a general historical sketch Krueg discusses the manner of formation of the fissures, taking the cat as less subject to variation than the dog. He then enumerates the fissures, with brief characterizations, under three heads: "Grenzfurchen, Hauptfurchen, Nebenfurchen." The detailed account of the fissures is divided into "Canidæ, Felidæ, Hyænidæ und Protelidæ, Viverridæ, Mustelidæ, Procyonidæ, Ursidæ, Phocidæ und Otaridæ." A separate historical sketch is given with each section, and four of the five folding plates of excellent outline figures are devoted to the carnivoral fissures.

In fulfillment of a purpose announced in 1873 (11,229), I have nearly ready for publication a somewhat extended paper upon the Gross Anatomy of the Brain of the Domestic Cat. The conclusions which I had reached respecting the nature, relations and nomenclature of the fissures accord in most respects with those of Krueg. In the hope that his paper may incite others to take up this branch of comparative anatomy, I desire, upon the present occasion, to point out the improvements which Krueg has made upon his predecessors, and at the same time to suggest some amendments to his views.

Krueg does not state whether the brain figured by him is intended as a type, or is merely selected from among the 12 adult brains which he examined. The following figures represent what seems to me to be a comprehensive type of the fissural pattern of the domestic cat, based upon at least 200 specimens, mostly prepared by myself.[1]

EXPLANATION OF THE FIGURES.

The figures are enlarged about two diameters. Fig. 1, the lateral aspect of the hemisphere and lobus

[1] In the Museum of Comparative Zoology at Cambridge, Mass., is a series of 42 cats' brains, more than half of which are young or fœtal, forming part of a collection to illustrate the Neurology and Embryology of Domesticated Animals made by me for the late Professor Agassiz. In the anatomical laboratory of Cornell University each student prepares, draws and dissects two or more brains.

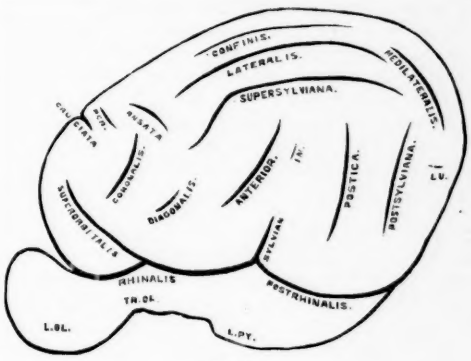

Fig. 1.

olfactorius; Fig. 2, the mesial aspect of the same, but as if viewed more from the cephalic region so as to expose the whole of the strongly curved fissura hippocampalis; hence the figure is somewhat foreshortened.

The constant fissures are shown as dark lines, the inconstant fissures as lighter lines. The f. olfactoria could not be shown upon these figures; it is a shallow groove upon the cephalic end of the hemisphere, and the lobus olfactorius rests in it.

The following abbreviations designate fissures: Ge.—Genualis; Ro.—Rostralis; Pmr.—Postmarginalis; Pr.—Postrhinalis; Pcr.—Postcruciata; Lu.—Lunata; In.—Intermedia. The name is placed above the fissure only in the case of the f. callosalis.

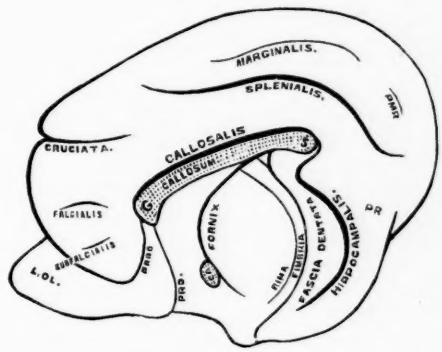

Fig. 2.

All of the names designate fissures, excepting the following names or abbreviations which refer to parts of the brain structure: Fornix; callosum—the corpus callosum; c. a.—the commissura anterior; rima—"the great transverse fissure;" fimbria—the corpus fimbriatum or taenia hippocampi; fascia dentata; S.—the splenium or caudal end of the callosum; G.—the genu or cephalic end; l. ol.—the lobus olfactorius; tr. ol.—the tractus olfactorius; l. py.—the lobus pyriformis.

The figures are diagrammatic, especially with reference to the structures represented upon the mesial surface; for instance the fornix is shown as a simple line.

The lines represent what may be called the *fissural integers*, and only those junctions are shown which, so far as I know, are constant in the cat. These are of the rhinal with the postrhinal, and of the sylvian with the point of their union; of the superorbital with the rhinal; of the callosal with the hippocampal, and with the preradical when it exists.

The following junctions I have never observed: Of the splenial with the postrhinal; of the splenial with the cruciate, which Guillot has seen once, and Krueg twice. Neither have I seen the union of the anterior and posterior fissures to form the "first or lowest arched fissure" of the Canidae. On the contrary, as stated by Krueg (2,613), and by myself (11,229), this union sometimes fails with domestic dogs; hence, in this as in many other respects, the cat presents less tendency to vary.

The following junctions are common: Of the diagonal with the anterior; of the postsylvian with the supersylvian; of the medilateral with the lunate, and with the lateral or the confinis; of the marginal with the post marginal; and of the ansate with the lateral or coronal or both.

A junction is usually marked by a less depth of the compound fissure at that point, constituting a concealed "transition convolution" or "pli de passage," which may be seen by separating the sides or by slicing off the cortex.

The fissura ansata is represented by me as a slightly curved line nearly at right angles with the lateral and coronal, and rather nearer the former. It is true, as stated by Krueg, that the apparent form of the fissure is usually triradiate; but the variations are so great that no single figure would fairly represent them all, and in two brains I have found the condition of things shown in the figure. This fissure demands fuller investigation, especially with reference to its representation in the human brain.

The sylvian fissure in the cat does not present the complexity observed by Krueg in some dogs and in Ungulata, and the "Insula" is not distinguishable.

My paper will contain a *synonymy* of the fissures of the cat's brain, with full references to the page and figure upon which a fissure is named or represented. In some cases there are 25 entries under a single head, and I trust the lists may aid others in the identification of the fissures as described by different authors.

ABRIDGED SYNONYMY OF THE CEREBRAL FISSURES OF THE DOMESTIC CAT.

Abbrev.	*Flower*, 1869. *Leuret*, 1839. *Huxley*, 1861, 1872.	*Owen*, 1868.	*Wilder*, 1873.	*Krueg*, 1880.	*Adopted in the present paper.*	
An				Ansata	Ansata	An.
A.		Ant. branch of ectosylvian	Ant. upright of ectosylvian	Anterior	Anterior.	A.
C.		Callosal			Callosalis	C.
Cf.		Part of medilateral.	Part of medilateral	Confinis	Confinis	Cf.
Co.		Coronal	Coronal	Coronalis	Coronalis	Co.
Cr	Crucial	Frontal	Frontal	Cruciata	Cruciata	Cr.
Di.				Diagonalis	Diagonalis	Di.
Fl.		Part of falcial		Genualis	Falcialis	Fl.
H.	Hippocampal. Dentate, H., 1861	Hippocampal		Hippocampi	Hippocampalis.	H.
L.		Lateral	Lateral	Lateralis	Lateralis	L.
Lu.					Lunata	Lu.
Ml.		Part of medilateral	Part of medilateral	Medilateralis	Medilateralis.	Ml.
Mr.		Marginal		Supraplenialis	Marginalis	Mr.
Ol.			Ectorhinal	Olfactoria	Olfactoria	Ol.
Pcr.				Postcruciata	Postcruciata	Pcr.
P.		Post. branch of ectosylvian	Post. upright of ectosylvian	Postica	Postica	P.
Pmr.				Postsplenialis	Postmarginalis.	Pmr.
Prd.					Postradicalis	Prd.
Pr.		Part of ectorhinal	Part of rhinal	Rhinalis post	Postrhinalis	Pr.
Ps.		Postsylvian	Part of supersylvian	Suprasylvii post	Postsylviana	Ps.
Prrd.					Preradicalis	Prrd.
R.		Part of ectorhinal	Part of rhinal	Rhinalis	Rhinalis.	R.
Sfl.		Part of falcial		Rostralis	Subfalcialis	Sfl.
Sp.	Callosomarginalis, (Fl. & H)				Splenialis	Sp.
So.	Supraorbital, (Fl)	Supercallosal		Splenialis		
Ss.			Presylvian	Præsylvii	Superorbitalis	So.
S.	Sylvian	Supersylvian	Postsylvian & supersylvian	Suprasylvii	Supersylviana	Ss.
In.		Sylvian	Sylvian	Sylvii	Sylviana	S.
					Intermedia	In.

The foregoing is an abridgement of this synonomy limited to writers who have made special additions to the technical nomenclature, and excluding those who have employed phrases or vernacular names, or who have adopted the names of other writers in purely physiological papers. Notwithstanding the importance of the contributions of Flower, Huxley and Leuret, the technical names employed by them are so few that they may be given in a single column. It is due to Krueg to state that several of the names now given had been already used in his paper on the Ungulata, in which he included a diagram of a dog's brain.

The principles of anatomical nomenclature are hardly identical with those of taxonomy, but it seems right that priority should prevail excepting when the name implies an incorrect or doubtful homology, or is practically very objectionable. Hence, Owen's "Postsylvian" should not be displaced by Krueg's "Suprasylvi posterior," or his "marginal," by "su-

prasplenialis." Likewise, Flower's "supraorbital" has priority of my "presylvian," which Krueg has adopted. On the other hand, Krueg's "anterior" and "postica" are so much more usable than previous names as to be worthy of acceptance, especially as they may be regarded as abbreviations of the phrases by which Owen and myself designated the fissures in question. "Splenialis" also is to be preferred to "supercallosal" or "calloso-marginalis," so long as the human homologue of the fissure is uncertain. If *marginalis* be retained, *postmarginalis* will be better than "postsplenialis."

I am particularly gratified to find that Krueg admits as fissural integers the *ansata* and the *diagonalis;* the former I had intended to call *transversa*, and the latter *intermedia*, but Krueg's names must be retained. We agree also in regarding Owen's "medilateral" as composed of two fissures, which Krueg terms "medilateral" and "confinis." I had intended to leave Owen's name attached to the fissure which is really mesiad of the lateral, and to call the curved division *lunata*. I still think this would have been preferable; but as it is, the name *lunata* may be given to what would otherwise have been *sublunata*. I have applied the name *intermedia* to a fissure which Krueg mentions, but does not name.

Doubtless my readers, especially those who are especially interested in the physiological aspect of the subject, desire to learn the correspondence between the cat's fissures and those of monkeys and man. I hope that Krueg may shortly give us the benefit of his opinion. Meantime, I am obliged to admit my doubts with regard to all excepting the callosal, hippocampal, and olfactory; for the Sylvian is not yet fully understood. I believe that for a long time to come the most useful work will be done upon nearly related forms, and that each fissure should be monographed with respect to its constant and variable characters, its connections, its relations to internal structures or to more primary fissures, and especially its manner of formation.

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CORRESPONDENCE.

To the Editor of "Science:"

Perhaps the following may interest the readers of "SCIENCE." It has always been my experience that a Black Snake, *Bascanion constrictor*, when confined with any other snake smaller than itself will invariably eat it. The following food has been eaten during the month of July, by a black snake five and a-half feet long, on exhibition at Central Park Menagerie: 3 leverits, 3 sparrows, 1 cat-bird, 1 small chicken, 1 black snake four feet long, 1 milk snake, 1 small rattlesnake; total weight, eight pounds.

W. A. CONKLIN,
Museum Building, Central Park.

DEATH OF A NATURALIST.

WE have to record the death of Mr. Green Smith, of Peterboro, New York, son of the late Gerard Smith, whose name will ever be remembered by those who value the cause of human liberty.

For many years past Mr. Green Smith left no opportunity neglected by which he could add to his fine collections of the birds of the United States. On one occasion he gave $1000 for 240 specimens of humming birds, and probably spent from ten to fifteen thousand dollars in forming his unique collection.

As Mr. Green Smith purchased specimens, they were prepared and mounted by the well-known taxidermist, Mr. J. G. Bell, of New York City, who appears to have been consulted by Mr. Smith on all occasions.

During his life Mr. Green offered his collection to the Museum of Natural History in Central Park, on the condition that the collection should be kept intact, and should bear the name of the generous donor. The offer, however, was declined by the trustees, on the ground that such a condition was inconvenient, and established a precedent which it was not well to encourage.

We have reason to believe that such refusal has been long since repented of, and some hope is expressed that this fine ornithological collection may still find a home in the Central Park Museum.

A GERMAN naturalist, in the course of inquiries as to the phosphorescence of the sea, has found that the phenomenon occurs whenever sea-fishes are brought into a three per cent. salt solution. The luminosity begins apparently in the eyes, spreads over the whole fish, and increases day by day. The fish after some time seems luminous throughout. The phosphorescent substance is a kind of mucus which appears dirty-white by day, and shines in the dark.

THE electric light is at last to be put to a crucial test in the city of London. Tenders are to be asked for the illumination of the principal thoroughfares of the area bounded by Cheapside and the Thames, from Blackfriars to London Bridge; the three bridges from London, Southwark and Blackfriars, along with Queen Victoria street and Ludgate Circus to Cheapside, through King William street to London Bridge, with a cross line from Cheapside to Southwark Bridge. No doubt there will be sharp competition.

A PLEA FOR THE METRIC SYSTEM IN MICROSCOPY.

By R. H. Ward, M. D., Pres. Am. Soc. of Micr.

One of the most important questions, theoretical and practical combined, which is now fairly before the microscopical world and still in an unsettled state, is that of gaining definiteness and uniformity in *micrometry*. In this field emergencies have arisen during the past year which have compelled me to take considerable responsibility, as well as to perform a large amount of work, trusting that the generous approval of my colleagues would accept and ratify what seemed at the time, and what seems now, most consistent with the interests of science and the dignity of this body. It will be remembered that a year ago, just at the close of our Indianapolis meeting, resolutions were offered favoring the metric system for micrometry, and the one hundredth of a millimeter as the unit to be employed, inviting foreign co-operation, and accepting an offer of standard micrometers from Prof. William A. Rogers, of the Astronomical Observatory of Harvard University. None of these points, save the last, were new or unconsidered. They had been studied at leisure for years by many members who were present. The metric system had been adopted by all the world except Russia, England and the United States; and its universal adoption was, as a rule, earnestly desired and favored by the educated and scientific classes. It had been adopted, or recommended, after mature deliberation, by the National Academy of Sciences, the American Metrological Society, the American Association for the Advancement of Science, by the American Society of Civil Engineers, the United States Coast Survey, the United States Marine Hospital Service, the American Medical Association, the Congress of Ophthalmologists, and by the largest State and local Medical Societies and by leading Medical Schools and Journals, by numerous Boards of Education, College Faculties and local Scientific Societies, and by experts in various branches of science and art. On the other hand the resolutions contained some minor faults, mostly in matters of taste or tact, which could have been easily remedied by reference to a committee. But there was no time for reference or for adequate discussion, and rather than discourage their object by failure or postponement, they were adopted and referred to the local Societies for consideration. They were passed unanimously, at a small session, it is true, but by the same vote which established this society and authorized its meeting here to-day. As too often happens, their incidental faults attracted more attention than their really scientific object. The unit proposed was evidently too long for integers and too short for fractions, and unlikely to receive a single approval either at home or abroad; the proposal of international action, though its object was universally approved, was in a form not likely to accomplish that object; and the liberal offer of Prof. Rogers was wholly misunderstood and perverted, until it took the form of the preposterous statement that it was proposed to make Prof. Rogers' micrometers standard as distinguished from those of other (!) makers, not the least amusing of all the blunders and absurdities of this precious statement being that of bringing the association, in any manner, by trade rivalry or mercenary considerations in relation with the work of one of our most generous scientists who has freely shared with the public every result of his labors, while pursuing them at an extravagant cost, and without a thought of pecuniary return. It soon became evident that an organized treatment of the subject was required to secure a proper and unprejudiced discussion of the objects of the resolutions. Feeling much responsibility as the presiding officer of this Society, and of one of the oldest of the local Societies, but having no authority to appoint an evidently necessary committee that should represent not only this Society but also sections of the country not yet named upon our rolls, I brought the subject before our local Association, and we invited all the Societies that could be reached to join with us in the selection of a National Committee for the consideration of this subject. The response from the large and active Societies, and from distinguished individuals, was a cordial and almost unanimous approval. Many of the Societies nominated to the committee members distinguished as specialists in this branch of microscopy; both Societies and eminent scientists contributed valuable opinions upon all the points at issue; and a large committee was organized which will, at a proper time, tender a report of progress to this Society. And while speaking of this committee, I will take the liberty of saying that it would be a pleasure to me, and I doubt not to all of us on this side of the lakes, if our friends from Toronto or Montreal, or any other points in the Dominion which may be represented here, would nominate members, and thus make it an American instead of a national body. To prevent confusion or misapplication of the practical suggestions which follow, and which naturally belong to this time and place, it is necessary to anticipate the report of the committee so far as to say that it will recommend to this Society to rescind its approval of the one-hundredth of a millimeter as the unit of micrometry, and to so modify the forms of the other resolutions as to leave the important questions of accurate measurement and convenient and scientific nomenclature in a favorable form for the attainment of valuable results.

Whether this Society, as such, shall continue to be known as actively interested in this reform, it is for you to say; though I sincerely hope that the members will unanimously agree with me in judging that it ought to do all that its influence, without dictation, can do in this direction. But I for one do not deem the decisions of Societies or other corporate bodies decisive and final. I am not much elated by their approval, or discouraged by their opposition. I have an average amount of respect for the motives but not for the efficiency of legislation. In State, in Church, in Science, it is possible and easy to carry out laws about in proportion as they are unnecessary. People who do not need government are easily governed. Persons who appreciate authenticated micrometers will use them if they can, with or without the approval of societies; and those who do not desire them will be about as little controlled by official decisions. While the encouragement and support of Societies and officials are welcome and valuable as far as it extends, I have more faith in the power of individual influence, and to that I look for an example which is able to settle this question beyond appeal.

In our micrometry we have the anomaly of a system of work capable of a precision almost, if not quite, unknown elsewhere to human art, for what other wholly artificial procedure possesses a demonstrated limit of accuracy inside of the 1-300,000th of an inch, and yet, until now, we have made no reasonable effort to free ourselves from avoidable errors known to be many times larger than that amount. While coal at $4.00 a ton and muslin at six cents a yard are, or at least pretend to be, measured with apparatus that has been carefully verified by standards of known quality, we have been measuring spaces almost infinitessimally small by standards of only commercial quality and possessed of manifest and uncorrected errors. This fact is too suggestive of the days when micrometers consisted of grains of sand and clippings of wire; with the odds against us that we know how to do better. Arrange your microscope so that it will magnify 3,000 or 4,000 times, making the one-thousandth of an inch on the stage seem three or four inches long through the lenses, then arrange an ocular micrometer so that the magnified one-thousandth of an inch shall be covered by, for instance, one hundred divisions of the ocular scale, and finally ascertain exactly how many of the one-thousandths of an inch on that or any other plate will be similarly measured by precisely the same one hundred divisions above it. Judging from my experience and from that of others who have tried the experiment, you will probably find a perfectly measurable discrepancy between the different spaces of the same name; so that even your own measurements, with the same apparatus, will not be comparable with each other unless, as is often done, you select some one average space as a basis of comparison, and are careful to use only that. Now we are trying to ascertain which of these various spaces is the correct one; or if not one is right, then to obtain one that shall be; or if that can not be done, at least to determine a known error from which we can compute definite results. This is not a question of makers, or dealers, or trade interests in any form, but of unmixed and independent science. We are attempting to procure a standard because we need it, and we hope for the cordial assistance of microscopists of really

scientific spirit in the difficult work of attaining it, and in the almost equally important task of bringing it into general and respected use. I call this a standard for convenience, and not in a strict or ultimate sense. Strictly it is only an authenticated copy of a standard, or a portion of a standard, namely, of the world's standard meter or standard yard; and hence, the importance, not fully shared by the original metre itself, of corresponding perfectly with its theoretical length.

The adoption of the metric system has a formal sound, and its difficulties have been, to say the least, well represented. But, to the extent of its use in micrometry, it really presents no difficulties and many advantages. The value of the millimeter and its decimals must be made familiar to the mind for other purposes, even for the understanding of exclusively English literature, and to use it for our measurements and statements will merely assist to keep it fresh in mind. The English system, or rather tradition, presents no pair of units so convenient for the microscopist as the millimeter for large objects and the 1-1000th millimeter for small ones. For the purposes of most people, for use in micrometry alone, it is sufficient to remember that the millimeter is about one twenty-fifth of an inch, and surely this is no great intellectual task. Nor would it waste a large portion of a lifetime to learn the whole series from the meter down, remembering that, in round numbers, the meter is a yard, with three or four inches to spare, the decimeter one-tenth of that 40 inches, or 4 inches, the centimeter one-hundredth of that 40 inches, or 4-10ths of an inch, and the millimeter one-thousandth of that 40 inches, or 4-100ths, or 1-25th of an inch. The real difficulty lies, I believe, not in memorizing the value of the few new units required, but in the awkward and useless habit of stopping to translate every item from the new unit to an old one. Any one can add a few new words to his vocabulary, a few new units to his tables, without harm. The telephone and the phonograph have brought no disaster along with their new double Greek names. An educated person can learn in an hour all the new terms, values and proportions of the whole metric system, with its interesting and suggestive relations; and the time would be well spent though he never used the system again. But I know by experience that he can also use it again, easily. When you once learn by a little practice to think in the new units the same as in the old, the apprehended difficulties vanish unaccountably and can scarcely be brought to mind. If asked to estimate the width of this room in yards, only a child unfamiliar as yet with the practical use of measures would say to himself, "It seems to be about 90 feet, which would be 30 yards." You would rather look at the wall to see how many times longer than a yard it is. So if you will take a metric rule, learn well how the millimeter looks, and its dek, the centimeter, and learn to use it in measuring and estimating the size of suitable objects, such as insects or flowers, you will find it as easy to think in millimeters as in lines, inches, feet, or yards, to say nothing of the comfort of knowing that you are in no danger of being lost between several kinds of the same name.

Aside from the selfish though sufficient motive of our convenience, I hope we shall practically adopt the metric system, because we can thus contribute a trifle of influence toward its general introduction. It seems plain enough now that our country made a serious mistake in not adopting it at first; and I am satisfied that it is still best for us to use it, notwithstanding the greatly increased difficulties in our way. It is not questioned that this is the best system ever tried or proposed, and the only one that can possibly come into general use; it is not denied that it would simplify education, and substitute order and intelligible relations for the confusion of our present metrology; it possesses as many points of convenient relationship to our old system as could reasonably be expected in any new one; it is admitted to be excellently adapted to all scientific work; it has been satisfactory to mechanics and manufacturers who have actually used it; it has been gradually and completely introduced into large shops using costly tools and machinery, without serious expense, and to the satisfaction of the managers. Almost without exception its friends are those who have used it, and objections to it come from those who have not. You hear less of the evils it has caused than of those it would cause. Furthermore, it offers us a carefully elaborated scheme of international co-operation, which we have but to adopt in order to place ourselves in harmony with the rest; the metric system is all international. It also unifies almost entirely the records made by persons adopting different units, since a statement of size will be practically the same to the eye and to the ear, and will require no formal mathematical reduction, whether in centimeters, millimeters, or in decimals of a millimeter. Fortunately we have all tried the experiment for ourselves, in one department, and know what some of the objections are worth. Our system of currency is precisely like the metric series of weights and measures; and is marked essentially by the same evils and benefits. Who now believes that having adopted a currency incompatible with the English system has caused us a hundredth part of the trouble it has saved, notwithstanding that it lacked the advantage of putting us in harmony with the rest of the world? Who now feels cut off from the past because of the change, or regrets the loss of the pounds and shillings so long as he has dollars enough and of the right kind (it is not easy to satisfy everybody about that)? Who has found the poor oppressed and the laboring classes annoyed by the system we adopted? Who has yet incurred a burdensome expense in hiring accountants skilled in a foreign and to us obsolete nomenclature to compute from the records of the past how many pounds, shillings and pence our grandmothers paid for their bonnets, or our grandfathers for their ships or their farms? The truth is the new system is so much better for our present purposes that we are glad to use it as soon as we fairly know how; and I believe that the same would be true of the whole metric system. We do not undervalue the records of the past, with their elaborate computations, and tables, and surveys; but few of the people of to-day come in contact with these directly, and those few could afford the extra trouble for the sake of the far greater interests involved. It is not scholars to whom learning in an unfamiliar form is a terror; they will spend lifetimes in working over such lore, merely for the pleasure of the work. And so much of it as is required for use in the daily life of the illiterate world is consistantly modified, and modernized, and adapted, by specialists of various kinds who inherit the progress of the past but adopt the fashions of the present.

To adapt a homely phrase which has remarkably vindicated itself, in another field in recent history, the proper way to introduce the metric system is to introduce it; not to decide why others should use it, but to use it ourselves. Nor need we wait to be certain of the feasibility of securing its universal use. It may be profitably used in science though not accepted in trade. The chemists have adopted it fully and with satisfaction in their work, in their teachings and in their books; the physicians are adopting it in different parts of the country, and the microscopists may well enjoy its facilities whether others do so or not.—(*Inaugural Address, Buffalo*, 1879.)

EXPERIENCE, says the *Electrician*, has shown that the life of a submarine telegraph cable is from ten to twelve years If a cable breaks in deep water after it is ten years of age it cannot be lifted for repairs, as it will break of its own weight; and cable companies are compelled to put aside a large reserve fund in order that they may be prepared to replace their cables every ten years. The action of the sea-water eats the iron wire completely away, and it crumbles to dust, while the core of the cable may be perfect. The breakages of cables are very costly, and it is a very difficult matter to repair them, in comparison with a land line. A ship has to be chartered at an expense of $500 a day for two or three weeks in fixing the locality, and in avoiding rough weather, as cables can only be repaired in the calmest seasons. One break alone in the Direct Company's cable cost them £20,000 to repair, and the last chance left to the company was to make an agreement with the Anglo-American, so that they should be protected and have the use of that company's line when their own was stopped.